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ABSORPTION FEATURES IN THE 3 μm SPECTRA OF HIGHLY OBSCURED OBJECTS

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Using the IRTF cooled-grating spectrometer (CGAS; Tokunaga et al. 1987) we have obtained moderate resolution 2.4-3.8 μm spectra ($\lambda/\Delta\lambda$ ~ 160) of a selection of infrared protostars and one object located behind the Taurus dark cloud (Elias 16; Elias 1978). Two examples of the spectra are presented in Figure 1. These observations were obtained with aim of comparing the shapes of the 3.07 μm H_2O ice absorption and the long wavelength wing at $\lambda > 3.07$ um. It is clear that the absorption near 3.07 μm is dominated by H_2O ice and a comparison between the spectra and a simple H_2O ice model allows a temperature estimate for the hottest ice-coated grains in these sources. Of particular interest is the fact that BN, Mon R2/IRS-3 and AFGL 2591 have absorption features near 3.07 μm that indicate grain temperatures of $\geq$ 70K. In addition, absorption which cannot be explained by H_2O ice exists on both sides of the H_2O ice absorption feature. The short wavelength absorption peaks near 2.8 μm and is associated with additional absorption at $\lambda > 3.07$ μm. The additional absorption longwards of 3.07 μm appears as a strong absorption peaking near 3.3 μm combined with a slightly weaker but broader absorption peaking near 3.45 μm. Higher resolution observations ($\lambda/\Delta\lambda$ ~ 640) showed no indication of the absorption due to the N-H stretching vibration of NH_3 near 2.963 μm in the spectra of BN and AFGL 989. This rules out NH_3 ice as an explanation for the 2.97 μm absorption feature observed by Knacke et al. (1982) and a $NH_3.H_2O$ ice mixture as an explanation for the absorption at $\lambda > 3.07$ μm. The most plausible explanation for the 3.3 and 3.45 μm features appears to be absorption by a mixture of hydrocarbons, although we cannot identify them with features already attributed to hydrocarbons in the ISM, reflection nebulae and Comets. However, at this resolution, these features appear the same for all sources in the sample, including Elias 16, thus implying a very similar mixture of molecules in each source.

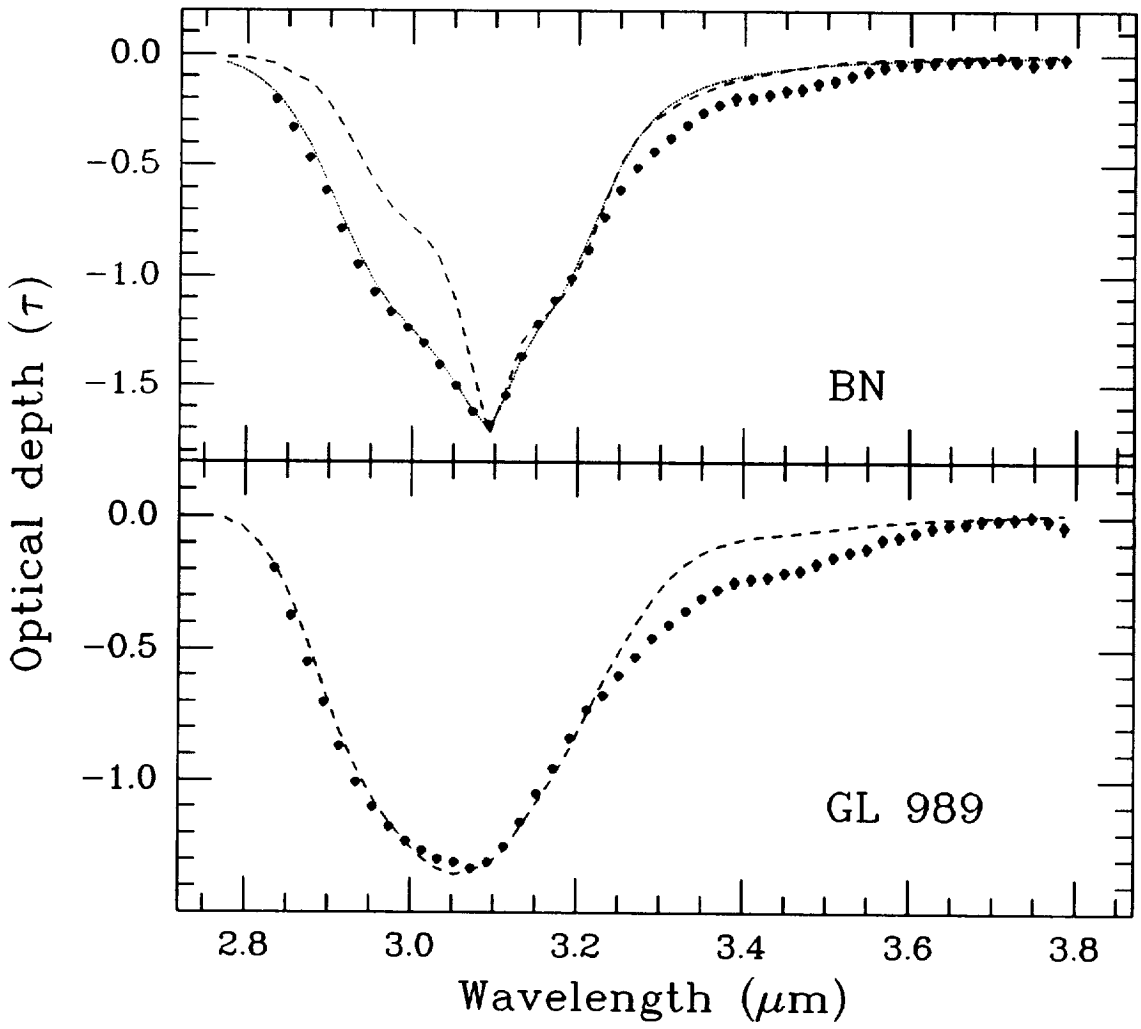

Figure 1. Spectra of two protostars, BN and AFGL 989, plotted in terms of optical depths. A simple model based on Mie Theory has been used to model the H_2O ice absorption in each source. For BN, the dashed line is a 150K ice model and the dotted line is a mixture of 23K, 77K, and 150K ices. For AFGL 989, the dashed line is a 23K ice model.

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